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# **Is The Use Of Kinesio Tape (KT) Effective In Reducing Pain Post-operative Anterior Cruciate Ligament (ACL) Surgery?**

Annabeth D. Pruett, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies  
Philadelphia College of Osteopathic Medicine  
Suwanee, Georgia

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## **ABSTRACT**

**OBJECTIVE:** The objective of this selective EBM review is to determine whether or not is the use of Kinesio Tape (KT) effective in reducing pain post-operative anterior cruciate ligament (ACL) surgery.

**STUDY DESIGN:** Review of three randomized control trial studies that were published between 2013 and 2017 in peer reviewed journals. Two articles were published in English language while one article was published in Polish language then translated to English language.

**DATA SOURCES:** All three randomized control trials were found via PubMed

**OUTCOMES MEASURED:** The primary outcomes measured by the patient and investigator was the efficacy of KT in the reduction of pain during a specific post-operative period. Pain was reported by the patient through the Laitinen pain scale and the Lysholm scale.

**RESULTS:** The first study showed statistically relevant differences when compared as intragroup but when compared as intergroups the results were insignificant (Chan MC, Wee JW, Lim MH. *Clin J Sport Med*. 2017;27(3):260-265. doi: 10.1097/JSM.0000000000000345. doi). The results found by Balki et al were determined to have insignificant differences (*Acta Orthop Traumatol Turc*. 2016;50(6):628-634. doi: S1017-995X(16)30222-X [pii]) while the last study was found to have significant differences (Boguszewski D, Tomaszewska I, Adamczyk JG, Bialoszewski D. *Ortop Traumatol Rehabil*. 2013;15(5):469-478. doi: 0.5604/15093492.1084361.)

**CONCLUSIONS:** The answer to whether KT is effective in reducing post-operative pain is inconclusive based upon the three selected studies.

**KEY WORDS:** kinesio tape, k tape, ACL

## INTRODUCTION

Dr. Kenzo Kase, a Japanese born licensed acupuncturist and chiropractor, invented the idea of kinesio tape (KT) in the 1970's.<sup>1</sup> The idea stemmed from his frustration due to the lack of treatment options available for osteoarthritis in the elderly. He would align a joint during a chiropractic session and when his patient would return, the joint had misaligned inducing pain again. He knew that taping the joint for extra stability was effective, however, there were not acceptable taping options for long term adhesive exposure. He also noticed that with joint injuries there was additional weakness to the muscle. Creating a tape that was flexible while strong enough to stabilize would allow for it to act as a muscle on the skin. The end-product of Dr. Kase's invention was kinesio tape which allowed for flexibility, stability, and long-term skin exposure through its hypoallergenic adhesive. His invention of KT unlocked treatment and physical rehabilitation options as well as meet the needs of many different populations ranging from Olympic athletes, elderly arthritis patients, and even injured horses.<sup>1,2</sup>

The knee joint is made up of many different structures which are responsible for the wide variety of causes of knee pain in individuals. The four bones involved in the knee joint (the femur, tibia, fibula, and patella) are stabilized through ligaments. In addition, there are multiple muscle attachments to the bones that aid in the stabilization of the knee. The anterior cruciate ligament (ACL) connects the lateral femoral condyle to the anterior aspect of the tibia and prevents an anterior shift of the tibia against the femur.<sup>3</sup> The most commonly injured knee ligament is the ACL with 100,000-200,000 ruptures per year. This translates to an average of 1 in 3,500 individuals in the United States.<sup>4</sup> The exact number of ACL tear related healthcare visits is not known; however, knee pain is in the top 20 reasons for healthcare visits in the US and accounts specifically for 1.2% of all healthcare office visits.<sup>5</sup>

Due to ACL tears being the most common ligament injury, there is a high prevalence of studies conducted on the mechanisms of injury and prevention of further ligament injuries. ACL tears are due to injuries with different types of mechanisms. About 70% is due to non-contact sports and the remaining 30% is contact sports, trauma, or contact collisions.<sup>6</sup> The mechanism of injury is a sudden change in direction that causes a large amount of valgus stress combined with internal rotation and anterior shift of the tibia.<sup>6,7</sup> An ACL tear diagnosis can be a large financial burden on the patient. According to a recent study comprised of 14,713 patients, the average cost of ACL reconstruction is \$24,707 in the US. This number does not reflect post-operative care of medications, durable medical equipment or physical therapy associated with the injury.<sup>8</sup>

The usual method of treatment of an ACL tear starts with the first-line treatment of any acute injury: rest, ice, compression, and elevation, also commonly known as RICE. Then the determination for non-operative or operative treatment is needed.<sup>7</sup> The decision for surgery is multifactorial based upon age, activity level, and degree of tear as well as the training of the physician. The standard of care is that individuals with instability of a chronic ACL tear for greater than 6 months should be considered for surgical reconstruction.<sup>3</sup> However, since this injury is associated with athletic injuries, many will opt for surgery in order to have a quicker return to play or maintain a high activity level. In contrast, the thought for surgery might be delayed or unexploited in a 70-year-old who tore their ACL going down the stairs. In the usual rehabilitation process, the use of durable locking knee braces is relied upon for stability of the joint. According to one post-operative ACL rehabilitation guide, the first 2 weeks of rehab is focused on decreasing inflammation (ice/massage), reaching 90° flexion (biking, stretching), as well as quadricep muscle strengthening.<sup>9</sup>

The above therapies are all used to help treat an ACL tear as well as rehabilitate from an injury. The goal in therapy is to reduce inflammation and pain and allow for strengthening and flexibility to reach the normal functionality of the knee joint. Many of the options include massage techniques, RICE method, and cryotherapy. KT is designed to help reduce inflammation, provide joint stability, and can act as a muscle on the skin. This treatment modality in combination with traditional therapies could open the ability to reduce post-operative pain.

## **OBJECTIVE**

The objective of this selective EBM review is to determine whether or not kinesio taping is effective in reducing pain post-operatively in ACL surgery.

## **METHODS**

The selected studies in this systematic review included three randomized controlled trials to review the efficacy of KT on post-operative ACL pain reduction. The populations were comprised of adults, 18 years and older, with post-operative ACL surgery. The outcomes measured from the applied intervention included the efficacy of KT in reducing post-operative therapy. The demographics and characteristics of the studies are displayed in Table 1.

The author of this review used the keywords “kinesio tape” or “k tape,” and “ACL” within the PubMed Database to find published studies from 2008 to 2018. The keywords were crossed checked in the Cochrane Database. The sources were selected based off their ability to answer the clinical question proposed by the author and if the outcomes measured were patient-oriented evidence that matters (POEMs). Two articles, Chan et al<sup>10</sup> and Balki et al,<sup>11</sup> were originally published in the English language while one article, Boguszewski et al<sup>6</sup> was originally published in the Polish language and translated to English Language. Inclusion criteria were

RCT studies published after 2008; while the exclusion criteria were studies published before 2008, meta-analysis and systematic reviews, and studies that did not specifically measure pain or ACL reconstruction post-operative. The summary of statistics reported were *p-values*.

**Table 1.** Demographics and characteristics of included studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Chan (2017) <sup>10</sup>	RCT	68	>18	>18 years old with a ACLR +/- concomitant partial meniscectomy	Age <18 years, patients who had underwent primary ACLR with concomitant meniscal repair or cartilage resurfacing procedures, revision ACLR, hx of previous knee surgery of involved limb, history of skin plaster allergy, and inability to speak English	8	Post-operative application of KT
Balki (2016) <sup>11</sup>	RCT	30	18-39	Male patients between 18-45 years old	Previous surgeries on lower extremity, females, multi-ligamentous knee injury, hx of KT treatment and systemic disease, outside age range of 18-45	0	Post-operative application of KT using muscle and lymphatic correction techniques
Boguszewski (2013) <sup>6</sup>	RCT	26	20-41	ACLR outpatients of John Paul II Western Hospital in Grodzisk Mazowiecki	Patients not of John Paul II Western Hospital or those not having ACLR	0	Post-operative application of KT using Y and I shaped tape technique

W/D= withdrawal, ACLR= anterior cruciate ligament repair

## OUTCOME MEASURED

Outcomes measured were focused on pain reduction post-ACL reconstruction. The Chan et al<sup>10</sup> study and the Balki et al<sup>11</sup> study recorded pain through the use of the Lysholm scale. The Chan et al<sup>10</sup> study gave the Lysholm patient answered survey on week 1, 2, and 6. For the purpose of this selective review, week 1 and 2 were used for consistency of the post-operative timeline. The Balki et al<sup>11</sup> study conducted the patient answered Lysholm survey on month 1 and month 3 post-operative. For the purpose of this review, month 1 results were used to reach

consistency on the post-operative timeline. The Lysholm Knee Scoring System was created in 1984 and has since been the gold standard method of testing for anterior cruciate ligament repair (ACLR) post-operative knee functionality. The score is composed of a total of 100 points and subjective to the patient based off of their symptoms with daily activities. The 100 points are broken down into 8 large categories and scored based off the patient's response. Of the 8 large categories, pain is worth a maximum total of 25 points with the following subcategories: constant pain (0 points), pain with or after walking less than 2km (5 points), pain with or after walking more than 2km (10 points), pain with during severe exertion (15 points), inconstant and slight during severe exertion (20 points), and no pain (25 points).<sup>12</sup>

The Boguszewski et al<sup>6</sup> study recorded patient feedback through the Laitinen pain scale. The patient-answered survey was conducted on Day 1 and Day 28 of the study. The scale is composed of four questions which assesses the patient's severity and frequency of pain, amount of used painkillers, and physical activity limitations. In each group the patients recorded their answers on a scale from 0 to 4 points.<sup>12</sup>

## RESULTS

All three articles selected for this systematic review were studies in which the control group received the same traditional physiotherapy for ACL reconstruction as the experimental group and were conducted as randomized control trials. The Balki et al<sup>11</sup> study's control group not only received traditional PT but also had a "sham" KT tape method as a placebo. The Chan et al<sup>10</sup> and Balki et al<sup>11</sup> studies were blinded while the Boguszewski et al<sup>6</sup> study was not. All three studies used continuous data.<sup>6,10,11</sup>

In the study conducted by Chan et al,<sup>10</sup> 77 participants were assessed for eligibility. The setting was a sports medicine center located in a primary tertiary hospital. Subjects were



recruited by undergoing an elective primary ACLR by the same sports orthopedic surgeon between the years 2013-2015.<sup>10</sup> Inclusion criteria was defined as > 18 years old with a need for ACLR with or without concomitant partial meniscectomy. Exclusion criteria was defined as follows: age <18 years old, patients who had previously underwent primary ACLR with concomitant meniscal repair or cartilage resurfacing procedures, revision of ACLR, history of previous knee surgery of involved limb, history of skin plaster allergy, and the inability to speak English. The exclusion criteria for previous knee surgery on an affected limb and previous ACLR surgery were used in order to prevent skewing of results due to the build-up of scar tissue versus a patient who had no previous injury. The skin plaster allergy was included in order to prevent a drop out rate due to the adhesive used on the KT. After the 77 were assessed, 9 were excluded due to not meeting inclusion criteria leaving 68 participants to be enrolled into the trial.

Patients were randomized into two groups, the control and intervention group, by using a computer generator. Thirty-five participants were assigned to the intervention group while 33 participants were allocated to the control group. The allocations were sealed by the study investigator and randomly assigned to the patient. The intervention group received KT in addition to standard physiotherapy. The specific taping technique involved the basket-weave method at 10% tension with the RockTape Kinesiology brand tape.<sup>10</sup> The tape was advised to be removed at the fifth day of application or at the first sign of a skin reaction. The control group did not receive taping but underwent the same physiotherapy performed by the same physiotherapists. Regarding patients lost to follow-up, there was a total of 8 participants: 5 from the intervention group (3 defaulted therapy and 2 had skin reactions to tape) and 3 from the control group (3 defaulted therapy). Therefore, the number of participants were 30 for both the intervention and control groups

Multiple outcomes were evaluated in the Chan et al<sup>10</sup> study; however, for the purpose of this review only the results from the Lysholm scale in the first and second week were observed. The mean and standard deviation of the control and experimental group were compared between week 1 and 2 using the Wilcoxon rank-sum test to produce a p-value. At week 1, the control group had a mean score of 56.77 while the experimental had a mean score of 52.70. At week 2, the control group had a mean score of 67.73 in contrast to the experimental group score of 66.37. The intragroup comparison produced a control p-value of 0.0002 while the experimental group had a p-value of <0.0001. The p-value limit for statistical significance is <0.05 meaning both groups were significant in their results. The results were also analyzed as an intergroup comparing the control group to the experimental group. These results were compared using the 2-sample independent *t* test producing a p-value. The control groups reported a mean score of 10.97 while the experimental group reported a score of 13.67 creating a non-significant p-value of 0.4174.

**Table 2.** Intragroup and Intergroup comparison of Lysholm mean score week 1 & 2, Chan et al<sup>10</sup>

Intragroup Comparison (Wilcoxon Rank-Sum Test)			
Group	1 <sup>st</sup> week	2 <sup>nd</sup> week	P- value
Control: non-taping	56.77 ± 18.41	67.73 ± 14.34	0.0002
Experimental: KT	52.70 ± 17.21	66.37 ± 15.27	<0.0001
Intergroup Comparison (2-Sample Independent <i>t</i> test)			
Group	2 <sup>nd</sup> week to 1 <sup>st</sup> week		P-value
Control: non-taping	10.97 ± 13.85		0.4174
Experimental: k-taping	13.67 ± 11.66		

In the study conducted by Balki et al,<sup>11</sup> 30 male patients were assessed for eligibility and were randomly assigned to two groups on post-operative day four. The setting of the study is unknown; however, all 30 ACLR were performed by the same orthopedic surgeon using a hamstring tendon autograft or allograft. Outlined inclusion criteria were male patients between

18-45 years old. Exclusion criteria was specified as having previous surgeries on lower extremity, females, multi-ligamentous knee injury, history of KT treatment and systemic disease, outside age range of 18-45. Using a randomization table, 15 patients were randomly assigned to the experimental group (KT) and 15 patients were assigned to the control group (sham taping). Patients received taping using a 5-cm wide KinesioTex Tape Gold. The control group received “sham taping” which included a 10cm long “I shaped tape” on the anterior and posterior thigh. The experimental group received “Y-shaped tape” on the anterior and posterior knee with an anterior lymphatic-correction taping technique.<sup>11</sup> Taping was performed two times during the first 10 days post-operatively and changed every 5 days. Physiotherapy was performed the first two weeks, 5 times a week, twice a week for four weeks, and a home program for the remaining 6 weeks. Regarding patients’ follow up, no patients were lost to follow up or dropped from the study. Specific compliance was not measured during the study. No adverse skin reactions were mentioned. A double- blind approach was used by the two researchers who performed evaluations and the application of KT.

There were multiple different outcomes measured. However, for the purpose of this review the Lysholm survey post-operative 1 month was focused on. The experimental group mean score was 72.33 while the control group mean score was 74.26. Using the paired sample t-test the intergroup p-value was determined to be 0.335, showing statistically insignificant.

**Table 3.** Intergroup comparison of Lysholm mean score postop month 1, Balki et al<sup>11</sup>

Experimental Group	Control Group	P-value intergroup
72.33 +/- 5.61	74.26 +/- 5.16	0.335

+/-: standard deviation

The last study conducted by Boguszewski et al<sup>6</sup> contained a total of 26 patients: 16 women and 10 men. The study setting and population was derived from patients seen at the John

Paul II Western Hospital in Grodzisk Mazowiecki. Patients were randomized into two groups; however, the method of randomization was not explicitly stated. The experimental group received KT in addition to physiotherapy while the control group received identical physiotherapy. The application of KT lasted four weeks in the experimental group in which the tape was changed every seven days. The specific brand of tape was not recorded. There were multiple different outcomes and measurements conducted in the study but for the purpose of this review, the Laitinen scale was used. This scale was conducted on post-operative day 1 and day 28. The specific taping application was a “Y-shaped tape” method with tension anteriorly and “I-shaped” tape laterally and medially. Physiotherapy sessions were conducted five times a week and supervised by a therapist. Neither compliance nor patients lost to follow-up recorded in the study.

The Laitinen pain score is composed of four individual characteristics of pain. For the purpose of this review, the characteristic focused on was pain intensity. For the experimental group receiving KT, the intensity of pain on Day 1 was 1.47 and on Day 28 was 0.47. The p-value was analyzed using the Student’s *t* test and was found to be  $<0.001$ . The control group receiving only physiotherapy on day 1 had a score of 2.09 and on day 28 a score of 0.91 with a p-value  $<0.001$ . The p-values for both groups indicate a statistically significant difference. The experimental group also showed a lower original score as compared to the control group from both day 1 and 28.

**Table 4.** Intragroup comparison of Laitinen pain score postop day 1 and 28, Boguszewski et al<sup>6</sup>

	Day 1	Day 28	P-value
Experimental Group	1.47	0.47	$<0.001$
Control Group	2.09	0.91	$<0.001$

## DISCUSSION

The results from the three RCT reviewed studies are inconclusive on the efficacy of post-operative pain reduction using KT. The intragroup p-values in both the Chan et al<sup>10</sup> study and the Boguszewski et al<sup>6</sup> study showed improvement with the KT as compared to the control group of physiotherapy only. The Chan et al<sup>10</sup> study also performed an intergroup comparison which did not show improvement. Therefore, this study showed significant improvement as compared to the individual group but when compared to each other, the results were statistically insignificant. The Balki et al<sup>11</sup> study showed no improvement in an intergroup comparison between the control and experimental group.

Many individuals in the US are uninsured or have inadequate insurance. According to the latest census performed in 2017, there was 28 million individuals without insurance.<sup>13</sup> As stated before, ACLR has a high cost for surgery alone, not including additional therapy, medical equipment, medications etc. Therefore, seeking ways to decrease the financial burden on patients is important. Kinesio Tape is roughly \$2.00 per roll and is widely available meaning the cost to the patient or to clinical entities is not high and is easily accessible. More studies should be conducted on the effects of KT post-operatively. If proven to be beneficial, the effects could be cost saving to the patient by lowering amount of money spent on medications or other therapeutic devices. Future studies could investigate a cost component with KT post-operatively. There were multiple limitations on the studies reviewed. The Chan et al<sup>10</sup> study had limitations regarding the length of KT application as well as not finding a way to eliminate a placebo effect with another type of taping. There was also 8 patients that dropped out either due to an allergic reaction or refusal to participate in therapy. The Balki et al<sup>11</sup> study had limitations of restricting participants to only men, a smaller group size of 30, and absence of a no tape group. Limiting the

population to only men decreases the ability to generalize to half of the population (women) as well as an absence of no tape group could have interfered with results. The Boguszewski et al<sup>6</sup> study was limited in their population size of only 26 patients as well as eliminating a placebo effect. ACLR has various approaches to surgery as well as graft differences that could have contributed to large differences in post-operative pain and functionality.

## **CONCLUSION**

After reviewing the three selected studies, the efficacy of KT post-operative ACLR is inconclusive. It is understood that a patient's response to surgery as well as their tolerance of pain is different. Therefore, each surgical patient is different in the post-operative period. Other factors could impact results in the post-operative period such as comorbid diseases, surgeon's level of expertise/approach used, graft type used, additional injuries to the knee, and patient's effort during physiotherapy.

Future studies are warranted to determine the efficacy of KT in the post-operative phase. Studies should include an analysis to see the effects of cost, include a larger group size of male and female patients, include 3 groups comprised of KT, sham taping, and no taping, and set a stricter inclusion criterion regarding the surgical approach and graft selection. Since ACL tears are the most common knee ligament injury with a high associated cost, finding a cheaper option that poses therapeutic benefit would be pivotal to treating patients post-operatively. This treatment technique should be continued to be studied on not only ACLR but on its benefits with other musculoskeletal operations.

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